SAVING ENERGY IN THE OLDER HOME

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FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

CONTENTS

IT'S WORTH YOUR WHILE!

Our national fuel shortage is now clearly visible. We must conserve our supply, and buy time to develop new sources.

There are many ways to reduce energy waste, often at no cost or discomfort. In fact, some simple improvements in older homes can yield *large* savings—savings in energy and *money*.

Whether you keep your home for years or sell it next month, you have a golden opportunity to invest in your property at a *high* return and little risk. You can get your money back with interest.

ENERGY SAVING BEGINS WITH STOPPING LEAKS

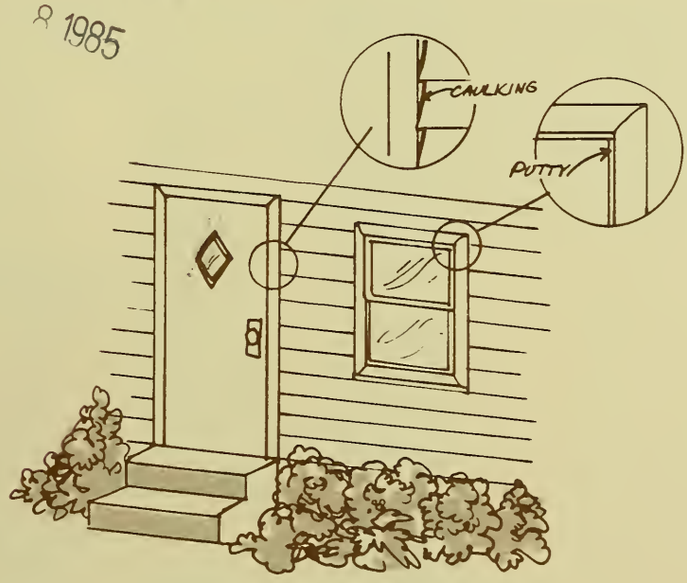
LEAKS

Chances are your older home has some leaks. Not water leaks in the roof or basement, but leaks of air—air laden with heat energy (and money). You may be heating (or cooling) all the air in your house over again every hour, or less.

Leaks are more common in the older home; it often was built less tightly, without weather-stripping or complete sealing, without vapor-seals. Time has caused wear or warping, and dried out putty and caulking. These leaks can be worse in wasting energy than having *no* insulation, but they cost a lot less to fix. Leaks can account for up to one-third of your energy losses. So this is the place to begin saving energy in your home.

FINDING LEAKS

Where do you look for leaks? Windows and doors are a starting point. Most windows and doors do not fit tightly in their frames; they need some tolerance to operate. Weather-stripping can seal these cracks without binding. Do you feel a draft near your windows and doors? Try running a lighted match or candle around them on a cold or windy day. Look for existing weather-stripping; is it missing or worn and ineffective? Check the putty or caulking around glass, and around the outside of frames. Is it old and dry, cracked or falling out? If so, the frame needs resealing.



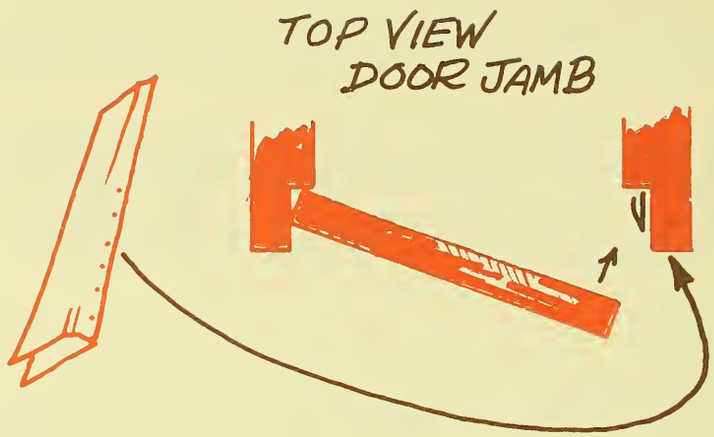
Poke around at the bottom of the siding, where it laps over the foundation. Is there a big opening there? Stuff it with foam-rubber or insulation, or even old newspapers. Look at intersections of exterior walls or where a wall butts against a chimney. Do these points need recaulking? How about pipes, conduits or vents through outside walls? Any leaks around them? If bath ventilators go on with lights, they waste heat. Install separate switches.

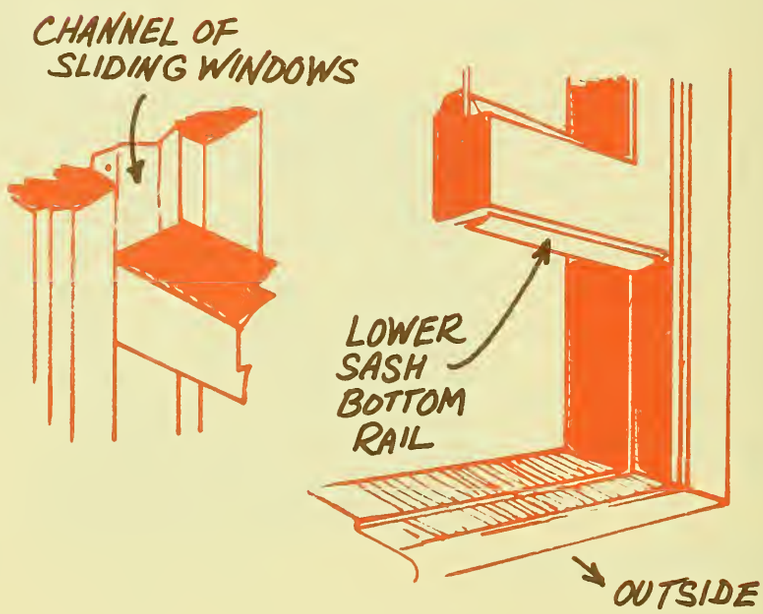
Don't overlook hatches or doorways into your attic or crawl space. Use weather-stripping around all edges, the same as with windows and doors. Check around the chimney in the attic. Is there a big space that lets heat escape into a cold attic? Stuff it with a fireproof material, like mineral wool. Don't use newspapers here: the chimney gets hot. The same goes for radiator pipes, passing through floors or walls, and electric fixtures in the ceiling. Patching plaster makes a good sealer where there is heat.

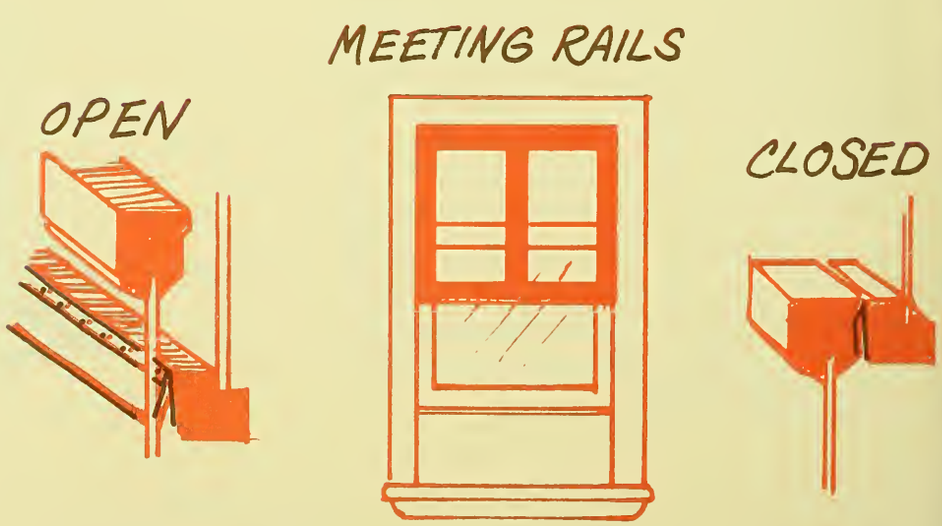
WEATHER-STRIPPING

Caulking cracks and stuffing holes requires little skill. Caulking can be neatly done with a tube or gun applicator.

Weather-stripping merits a second look. There are many varieties; they vary slightly in use and some are more durable than others.
Spring metal strips are a common type and are the most durable, though a little difficult to install. They are tacked inside a door jamb, at sides and top, in the channel of sliding windows, at the closing rails, and on one side of the meeting rails. Pivoting windows are treated like doors.







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  7 260 0    Madison, Wis. : b University of Wisconsin--Extension, Cooperative
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  8 300      i, 12 p. : b ill. ; c 28 cm.
  9 490 0    [Publication] / University of Wisconsin--Extension, Cooperative
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 11 500      "July 1978."
 12 504      Bibliography: p. 12.
 13 650  0   Dwellings x Energy conservation.


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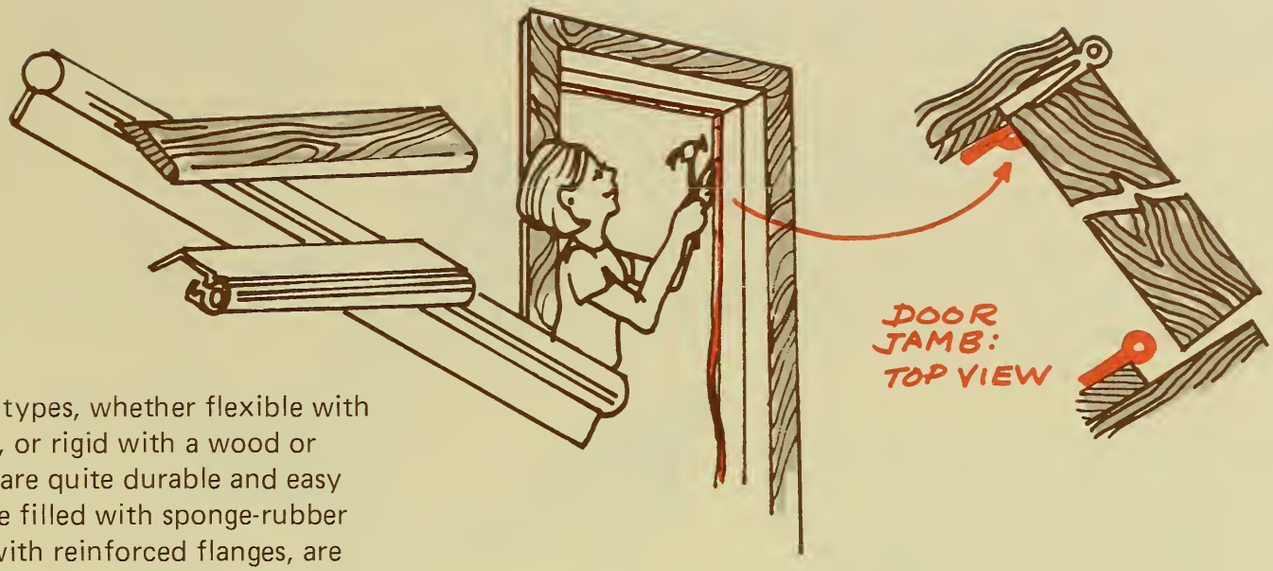
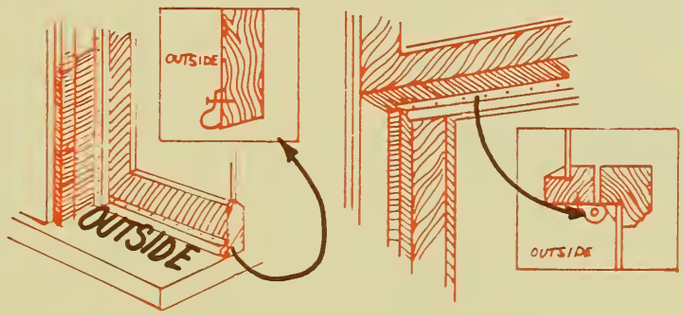
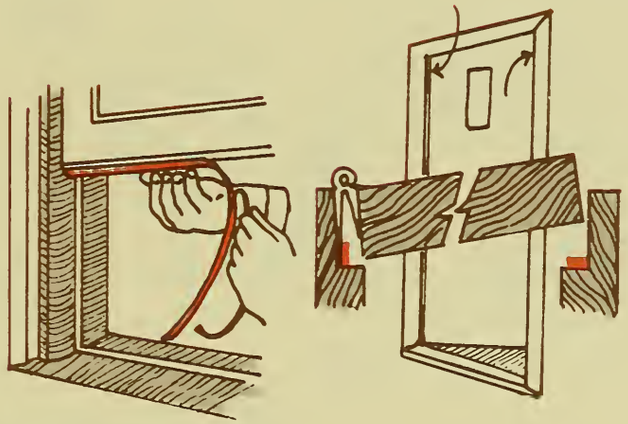


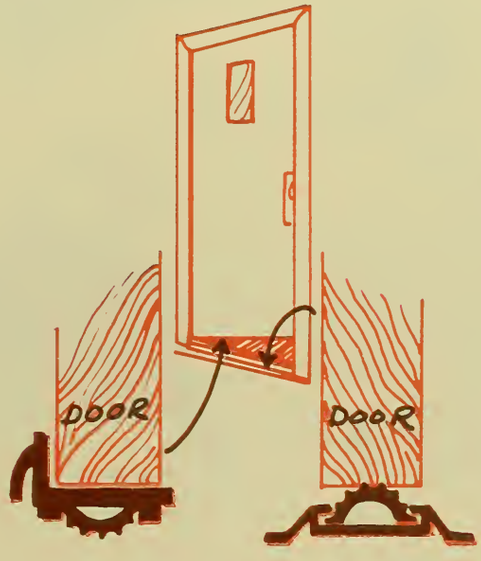
Tubular gasket types, whether flexible with a nailing flange, or rigid with a wood or metal backing, are quite durable and easy to install. Those filled with sponge-rubber or plastic and with reinforced flanges, are likely to last longest. They are tacked to door stops at sides and tops, so the tubing is compressed when the door is closed. On sliding windows, they are nailed at the sides to window frames and at the sashes to the rails. They can be placed inside or outside. They will stay resilient longer inside, but are more noticeable.



Foam or felt strips are less durable, and should not be used at points of wear, as at sides of sliding windows. Foam comes adhesive-backed, but some felt strips require tacking. Their application is simple, and they are adequate for many uses.

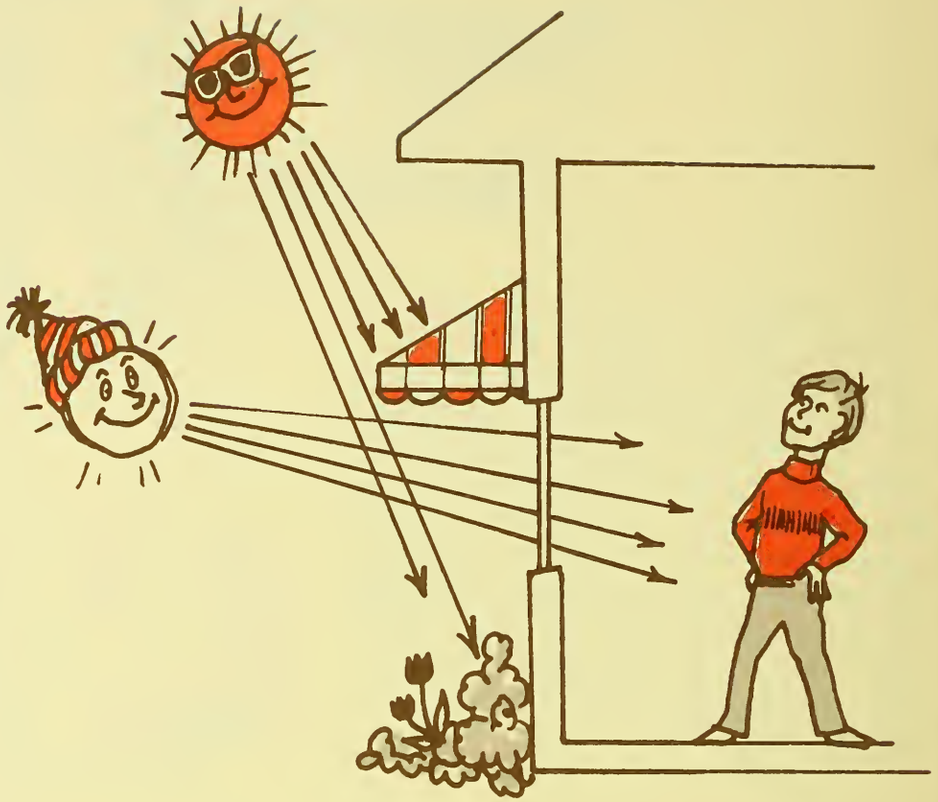


Threshold seals at door bottoms are very important, as cracks here may be large. Most threshold seals have replaceable vinyl closures. Some are mounted on the floor or threshold, some on the door.



YOUR PLACE IN THE SUN

We tend to take the sun for granted, and give it little thought. We forget that it is the source of *all* our energy: of all the gas and oil and coal, of all the wood and wheat and corn, of all the water-power, on our earth. It continues to radiate light and warmth to us every day, and we don't get a bill every month to remind us.

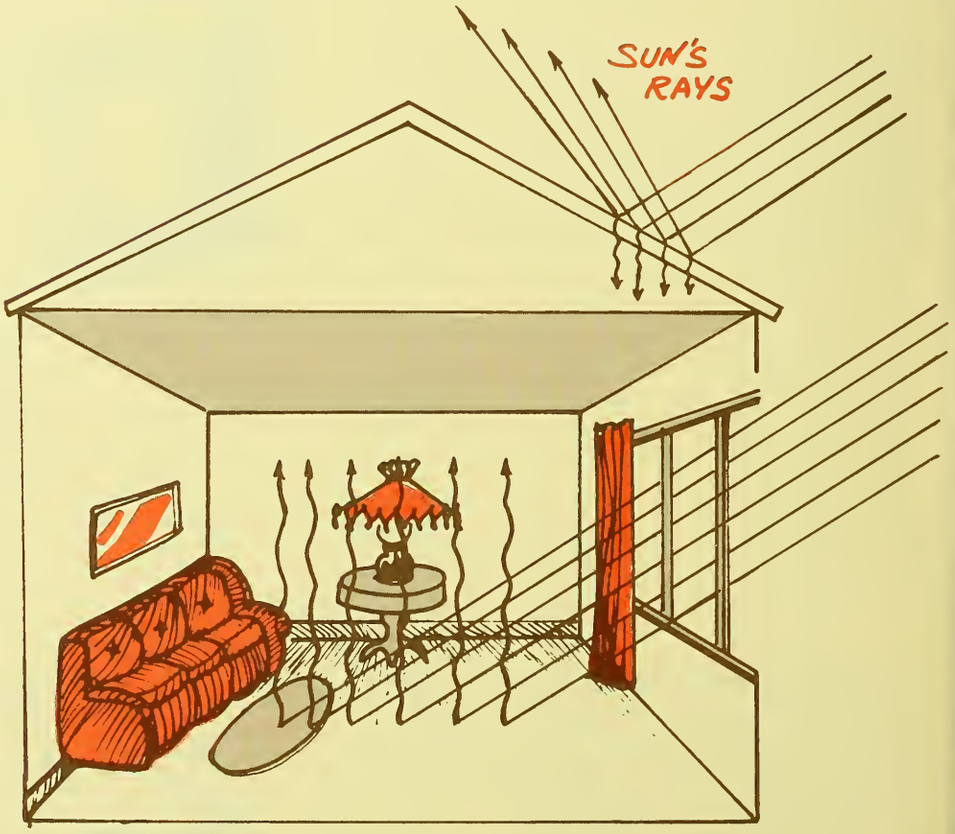


Much can be done in designing a new home to get maximum solar benefits, but it's not too late to improve your older home. You can't change its orientation or location, or build it into a hillside, but you can do the most with what you have.

The sun warms your home by radiation to all its exposed surfaces. Some of this heat is reflected, depending on the nature and angle of the surface. Some is stored in the construction; some passes through to warm the interior. We can keep heat out by painting walls a light color, by more reflective roofing, or by shades or blinds in windows. We can keep the sun out by shading with overhangs or other devices. Or we can absorb more solar heat by using dark surfaces and by taking full advantage of glass areas. How we want to control solar heat depends upon outside temperatures.

In the north, in winter, we want to absorb all we can get to reduce the heating load. In summer, we want to keep heat out. This is the object, much of the time, in hot climates.

The indians of the southwest learned long ago to reflect heat with light colors, and to use few, small windows, and thick walls of adobe to *store* heat for the cool nights.



LETTING THE SUN IN

Your home is a natural "heat trap." Solar heat accumulates through all its surfaces, but most of it streams through the transparent glass areas. These can be "solar collectors" in winter, when the low sun strikes south-facing glass more directly, admitting a large proportion of solar heat.

Windows facing south, southeast, or southwest are best for this. They absorb more heat in winter than do east or west windows, and are easier to shade against summer sun. To take full advantage of winter sun, use drapes or curtains that can be opened full in south windows. Keep them closed on cold nights or sunless days, to reduce outward radiation.

KEEPING THE SUN OUT

In the summer or in hot climates, you will want to exclude solar heat, and to take full advantage of your windows as ventilators. If you have air-conditioning, keeping the sun out costs less than pumping it out. Many homes have roof overhangs, designed to exclude the high summer sun by shading south windows. A covered porch can do this too, as can tall shade trees (that lose their leaves to admit the sun in winter).

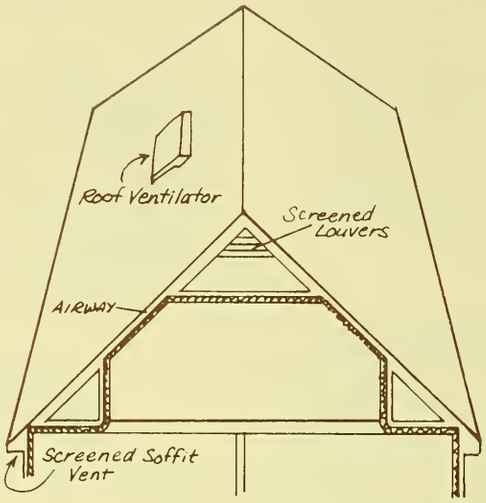
But if you are blessed with none of these, there are some useful devices you can use. Exterior shades are most effective: all shades absorb some heat, so it is better if the shades are outside than inside the home. Louvered projections above the windows can be attractive and economical; you might do-it-yourself. These can be designed to block the high summer sun, but to admit solar heat in winter. Awnings are an alternative. Operable shutters are an old device: if louvered, they permit air circulation; if solid, they reduce conducted heat. Louver-type insect screens are also obtainable, and can stop about 80% of sunlight on the south side. Interior venetian blinds or light drapes can reflect most solar heat, but heat they absorb warms the house.

East and west windows are more difficult to shade effectively since sun is lower, so they admit far more solar heat in summer months than a similar south window. Old-time operable shutters will work, but they block both light and view. Awnings and louvered screens are less effective here. Most effective for east and west windows is a combination of tall deciduous trees, and lower protective shrubbery. A vertical sunshade like a louvered fence can help. Interior venetian blinds or light drapes, again, reflect some heat but also absorb heat.

Solar heat is not a problem with north-facing windows, and this may make them highly desirable in hot climates, but in cold weather they lose a lot of heat by conduction, without yielding any solar gain. In fact, if you have some north windows you don't use, as in a bath or extra bedroom, you might consider filling the space with insulation and closing off with plywood.

ROOF VENTILATORS

Attics or other roof spaces are usually ventilated to dispose of moisture from living spaces. This is particularly important where no vapor barrier was used in the ceiling. Good ventilation can also greatly reduce high attic temperature in the summer, keeping living spaces cooler. Screened vents are usually provided in roof overhang soffits, with a higher roof ventilator near the ridge, or at gable-ends. This allows natural air circulation through the attic. Power ventilators can also be used when solar loads are high, cutting in automatically at a given attic temperature.



STORM WINDOWS AND DOORS

We have looked at problems of air leaks in windows, and their transparency to radiant heat. They share a third problem with doors: both are poor thermal insulators, and both lose a lot of heat by conduction.

A single-pane window may lose twenty times as much heat as an equal area of well-insulated wall. Double glass can cut this high loss in half; triple glass to one-third.

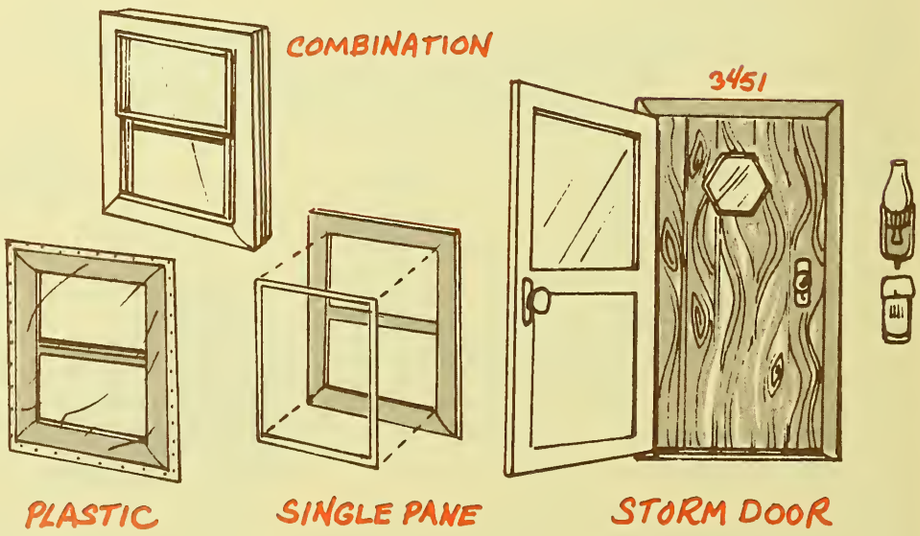
In an older house, the least costly solution is to put on storm windows. They will cut conduction losses roughly in half, the same as double insulated glass, and further reduce air leakage, too.

A sheet of six-mil polyethylene plastic can do the job. Tack it to the outside of the window frame, or tape it to the inside. The latter is easier and protects the plastic; it will hinder the view, but it's cheap and will save a lot of heat.

For better permanence at higher cost, single pane storm windows can be used. These normally can't be opened for ventilation, and are usually replaced by screens in the summer. But it is possible to hinge a few of them at the top, and buy hardware to swing them open for ventilation.

Combination windows, (with screens), are the most convenient kind. You can leave them in place year-round, and most can be removed for washing entirely from the inside. They are also the most expensive.

A solid wood door has about the same conduction loss as a window with storm sash, but air leakage will be higher. In the colder regions, glass storm doors will save heat, but take longer than windows to pay for themselves. Combination storm doors (with screens) are a convenience and allow ventilation. If you live in a mild climate, and have screens, don't worry about storm doors. If climate factors are extreme, hot or cold, consider replacing your doors with specially insulated ones, or adding solid wood storm doors.



WRAPPING IT UP

When you want to keep something warm or cold, you wrap it up in a blanket; this is what insulation is. Like a good blanket, it costs money and comes in several qualities.

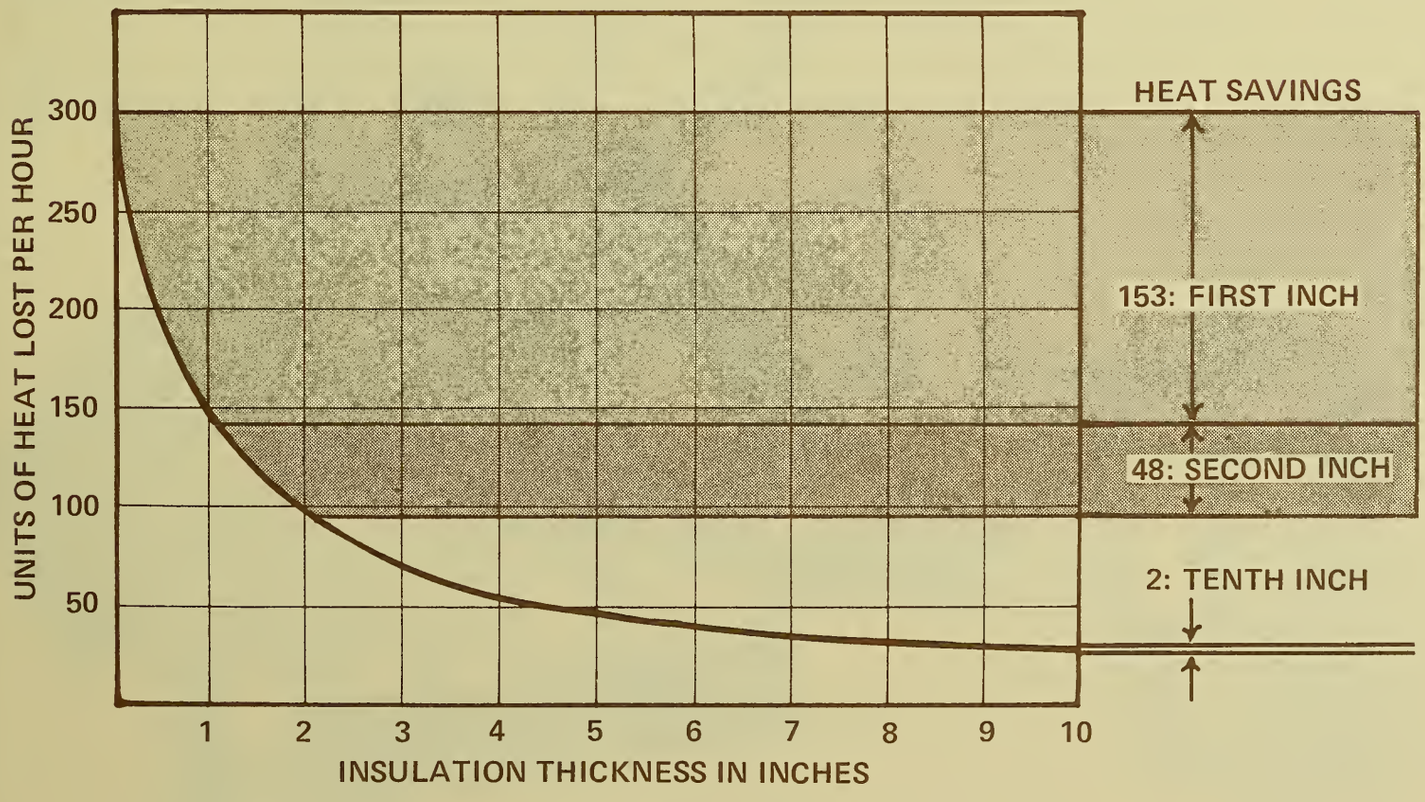
Before you buy insulation, there are two things you need to know. First, insulation *slows* the passage of heat; it lets your furnace burn at a slower rate, or less frequently, saving fuel. But the amount of fuel saved is not proportional to the thickness of insulation. If you apply one inch of insulation, say that it saves 153 units of heat per hour. If you apply a second inch, it will save only 48 units—less than one-third as much as the first. The tenth inch will only save 2 units!

You reach a point where another inch doesn't pay for itself—so you *can* have too much insulation. When adding small amounts to existing insulation is difficult and costly, forget it, and look at less costly ways. Look harder for leaks; put storm windows on the north side; add attic insulation instead of opening up the walls.

The second thing you need to know about insulation is about "R" factors: "R" stands for **resistance** to heat flow. All building materials have some "R" value; this value is high for insulating materials. It is marked on the label by manufacturers, and is proportional to the thickness used. Your uninsulated frame walls may have an "R" value around 4, the sum of the values for each material in it. If you add R11 insulation, you get a total "R" of 15.

"R" is a relative value; energy savings are not proportional to "R" either and each increase results in *smaller* savings. The "R" value you ought to have depends upon your climate and the local cost of your fuel. The cost of insulation is also a factor, including interest on your investment. In an older house, there are usually practical limits imposed by the construction.

In most areas of the United States, you should have at least R19 in ceilings, and R11 in walls and in floors over unheated spaces. In milder parts of the south, when air-conditioning is not used, less may be enough. In north central areas, the northern half of New England, and most of Alaska, you need more *if* costs make it practical. Much depends on how much you already have, and how much savings you can gain at *diminishing returns*.



INSULATE CEILINGS

An unfinished attic with exposed joists is easiest to insulate. You can use mineral wool batts or blankets, loose fill of mineral wool, cellulose or vermiculite. If you do it yourself, the mineral wool batts are probably easiest to handle, and can be placed quickly and neatly. If you now have no insulation, buy batts with a vapor barrier and place the barrier on the ceiling side. If adding insulation, buy batts without barrier, or slash it at intervals to allow vapor passage.

When joist spaces are full, you can build up a second layer of batts over the joists, if you want to go to 10 or 12 inches. Lay the second layer at right angles to them. Keep the skin covered and wear work gloves; the fibers can be irritating. Keep batts back from the eaves, so they don't block eave vents.

You can also pour the loose types from their bags, but this type is harder to get level. You can do it with a board, or the back of a rake. Wear a respirator with the mineral types, as you will raise some dust.

Urea-formaldehyde foam requires special equipment and experience. If your attic has a floor, you will have to remove some boards, or drill holes. Have a contractor fill the joist spaces with blown-in loose fill, or urea-formaldehyde foam.

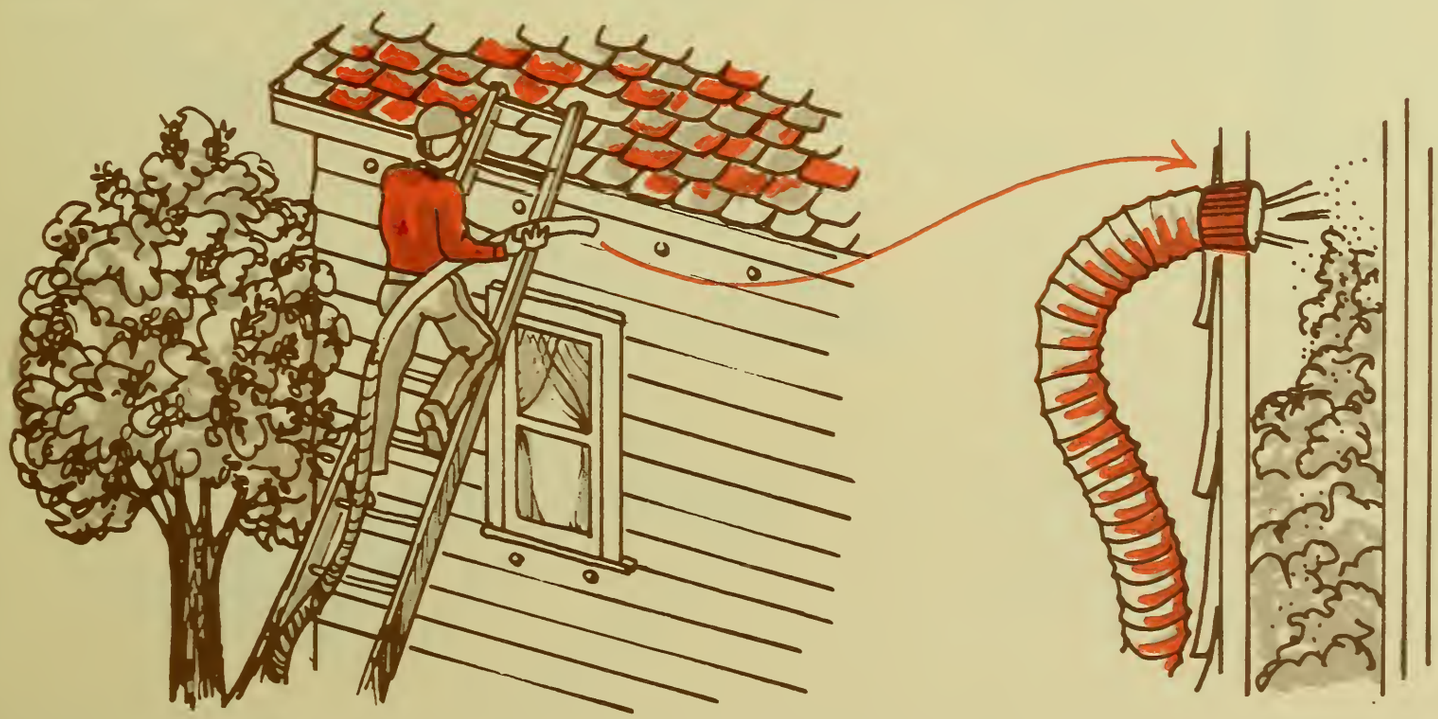
If you have a finished attic with knee-walls, you need to enclose the heated space, (see illustration p. 11) including end walls. Batts are probably best, with vapor barriers on the warm side. Stud depths and rafter ventilation space will limit possible "R" values.

Choose a contractor carefully: there are a lot of fast-buck artists around. Check your local better business bureau. Get estimates from several firms. How long have they been in business? Ask for and check customer references. Do their products meet federal or industry standards?

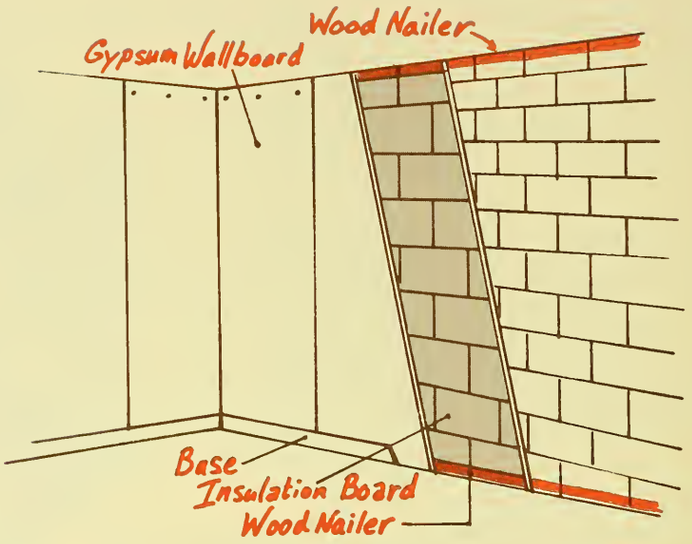
INSULATE WALLS

Frame walls in an older home can be insulated with blown-in loose fill types, usually mineral wool or cellulose fiber. Urea-formaldehyde foam is also widely used. All are forced in through holes drilled in the outside or inside walls. Often the outside is easiest to restore, after removing one or several rows of clapboard or shingles to drill the holes. All stud spaces must be completely filled, often requiring several holes in each stud space. Special equipment and expertise is needed, so it is normally contractor installed.

In a standard wood-framed wall, "R" values added will run about: 10 for mineral wool, 13 for cellulose fiber, 15 for urea-formaldehyde. Comparative costs should run in the same order, so you can judge the best value. Remember that you are buying "R"s, so divide the total price by the above values to get dollars per "R" for each type you price. In colder areas, it could pay in energy costs saved to use the better insulators at some premium per "R".



Masonry walls, as in a heated basement or crawl-space, can be furred out and insulated with batts. But the new foamed plastic boards have higher "R" values and are moisture-resistant. Polystyrene or polyurethane boards can be easily installed with adhesives. But they should be covered with adhesive bonded panels or gypsum board to provide fireproofing.



INSULATE FLOORS

Floors over unheated spaces can be easily insulated with batts. Start at one wall and staple chicken wire to the bottom of the joists. Slide the batts in the opening with vapor barrier *up.* Use short pieces of wire and batts to make it easy.

If the batts are about 3-1/2", (R11), there will be an air-space above. But if you use batts with an aluminum foil vapor barrier here, the reflective layer at the air-space will increase "R" to 13. If there is a gypsum board ceiling, as in a garage under living spaces, remove enough of the center area to slide batts to the walls. Support the center batts with a few wires until you can replace the gypsum. Gypsum is hard to salvage; plan to replace with new material. Be sure to put it back—it is your fire barrier.

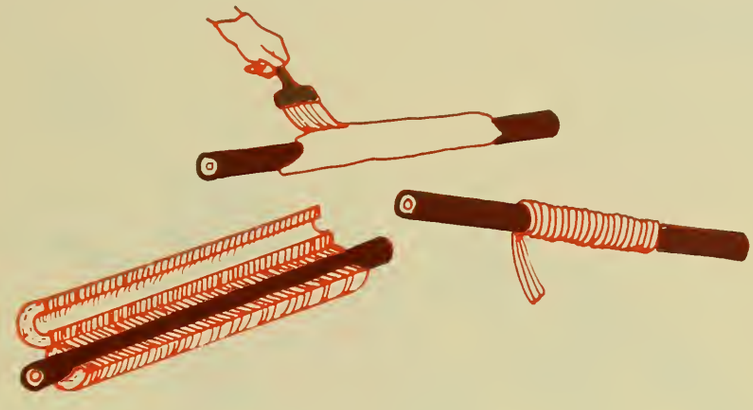
INSULATE DUCTS AND PIPES

Heating or air-conditioning ducts in your attic, garage or crawl space, or any other unconditioned space, need insulation. Heating ducts in a basement partially warm it and this may be desired.

The amount of insulation to use depends upon temperature difference, inside to outside, of the duct. Heating ducts in a cold attic need 4" mineral wool blankets; air-conditioning ducts may do with 2", if outside temperature is not excessive. For air-conditioning, use batts with a vapor barrier, placing it on the outside.

Batts are wrapped around in short sections, with the joints sealed with special tape. Don't wrap too tightly, especially on rectangular ducts. Tape any leaks in the duct joints before wrapping.

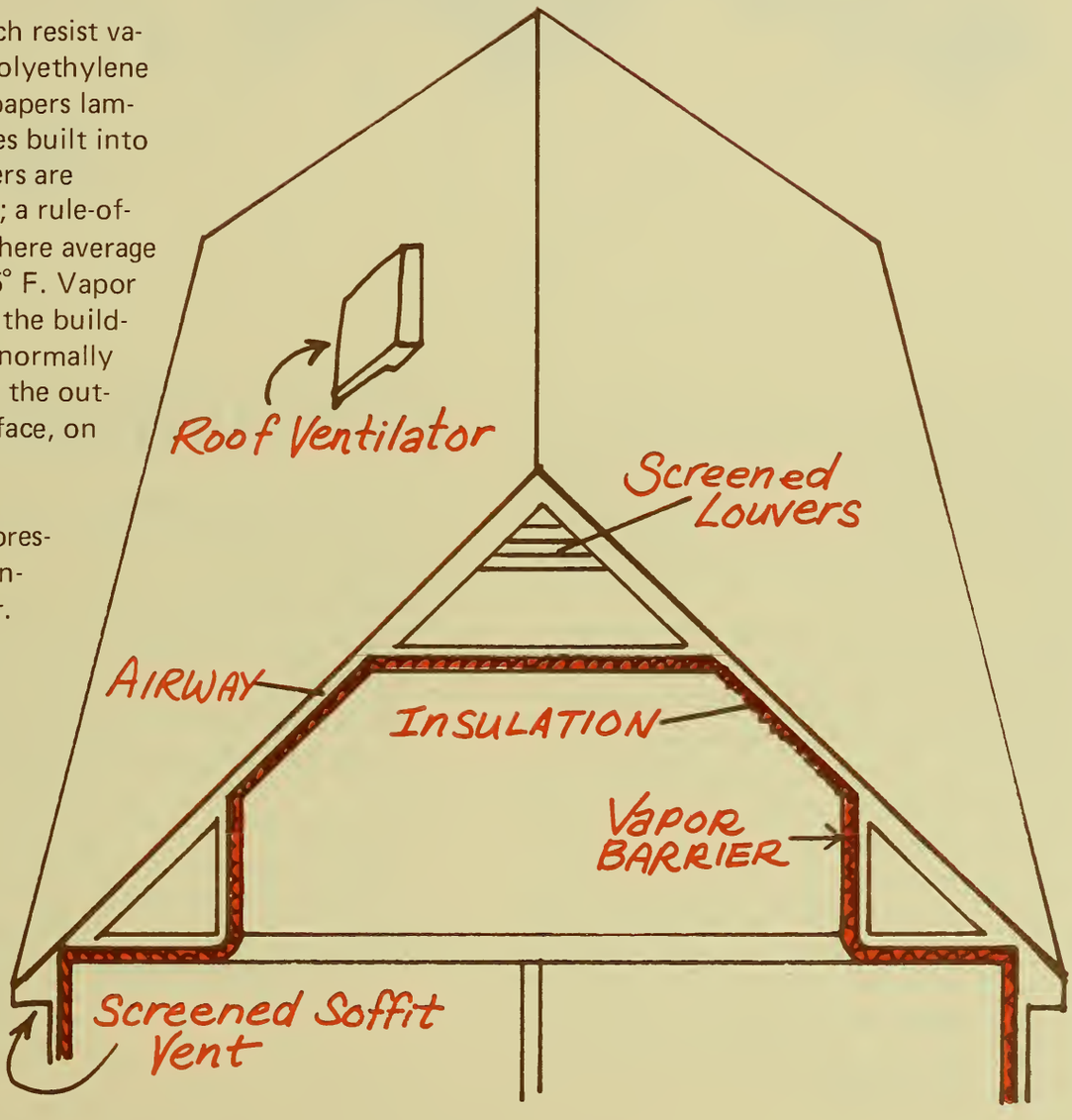
Insulate your steam or hot water pipes to reduce heat loss, unless you want some of it in an unheated basement. (Insulation on cold water pipes can prevent condensation; dripping in a humid basement can be stopped with "anti-sweat" pipe covering.) Some pipe coverings are made in tubular form, split in half for application, in sizes to fit standard pipes and fittings. Others can be wrapped around, or even "painted" on.

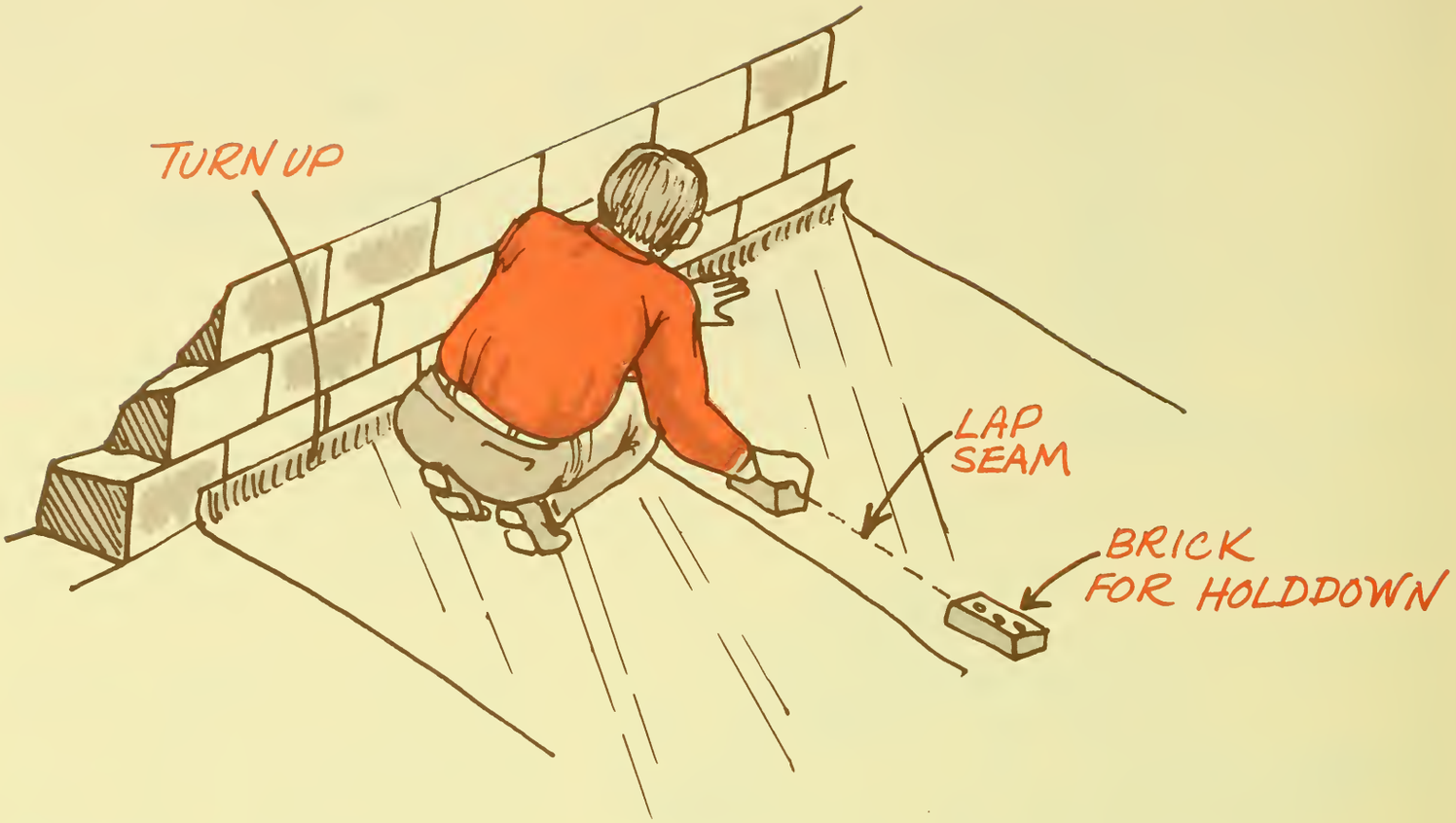


VAPOR BARRIERS

Vapor barriers are materials which resist vapor passage. Aluminum foil or polyethylene sheet are good examples. Kraft papers laminated with asphalt are sometimes built into insulation blankets. Vapor barriers are recommended in colder climates; a rule-of-thumb is use them in any area where average January temperature is below 35° F. Vapor barriers are placed in all parts of the building envelope where insulation is normally used, between heated spaces and the outside. They go near the inside surface, on the *warm* side.

In winter, there is a large vapor pressure difference between heated inside air, and cold, dry outside air. This pressure forces gaseous water vapor through most building materials. When it reaches a colder surface, it can condense into water within the construction, or cause paint to blister on the outside. A vapor barrier prevents or retards this passage of water vapor.





A vapor barrier may also be needed to prevent ground moisture from reaching wood framing, where it can condense and cause decay, as in a crawl space in any climate. Here it is placed directly on the ground.

Older homes built 20 years or more ago often do not have vapor barriers, and usually little or no insulation. When insulation is added the need for a vapor barrier increases. But it may not be practical to apply a vapor barrier in a wall, or under a layer of existing insulation in a ceiling. When it comes to tearing out plaster or gypsum board, you may prefer to experiment without a vapor barrier. The need depends on: interior humidity, the number in your family, the degree of water use, and the ventilation. Good attic ventilation can be an adequate substitute.

If you see signs of a problem, such as staining in the ceiling or paint peeling on outside walls, a good oil paint on the interior will give a fair vapor seal. There are vinyl wallpapers that would work well. You could try these first in baths or kitchens, where humidity is often high.

FOR FURTHER STUDY

1. "Tips for Energy Savers," Federal Energy Administration, Washington, D.C. 20461, (free).
2. "Making the Most of Your Energy Dollars," 1975, U.S. Dept. Commerce, National Bureau of Standards, for sale by the superintendent of documents, U.S. Government Printing Office, Washington, D.C., 20402, price 70 cents.
3. "In the Bank . . . Or Up the Chimney?" 1975, Department of Housing and Urban Development, for sale by the superintendent of documents, U.S. Government Printing Office, Washington, D.C. 20402 price $1.70.

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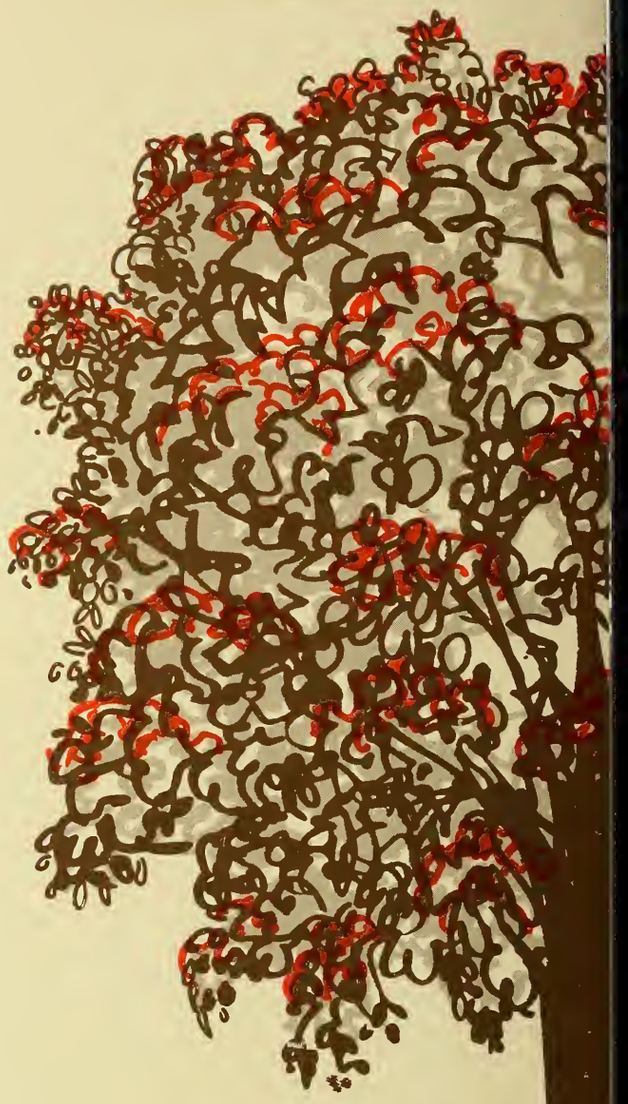

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